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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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COUNTRY Lithuania/USSR/Germany/Austria/Italy

DATE DISTR.

SUBJECT Culvert Design Formulas

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NO. OF ENCLS. (LISTED BELOW)

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SUPPLEMENT TO REPORT NO. [redacted]

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THIS IS UNEVALUATED INFORMATION

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[redacted] note: The method in use for computing the required waterway area for culverts and the discharge flow of water or the maximum discharge of water for culverts from rainfall and/or bridges from melting snow.] 25X1X

1. The waterway area is currently computed in the USSR and Lithuania by the empirical formula of the HKT HK ПC (Ministry of RR, Scientific Committee) and is applied to all highway design through some changes by the Central Bureau of Soviet Highways - MBД CCCP.

This formula is the Soviet equivalent to the Talbot formula used in the US

$$Q = \frac{M_1 \cdot M_2}{n} C \alpha E$$

in which:

Q - is the maximum discharge in cubic meters per second; M_1 and M_2 - are coefficients dependent upon the area of run-off, soil, terrain, etc.

$M_1 = M_2$ or 1 and $n = 1.25$ for use as an assumption.

C - is a climatic coefficient (with value established for different zones in the USSR). This is founded on lines of equal rainfall. There are 120 rainfall lines similar to contour lines on the earth's surface. In the Ukraine, for example, C = 14.

α - is a coefficient of retardation as the water flows towards the potential culvert.

A table presents these coefficients for the respective areas. For example, in the Ukraine the coefficient is 0.863.

E - represents the run-off area in square kilometers.

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2. Method of Computing

First - Assume the type of culvert, approximate dimensions and the depth of "water flow" in the culvert. The depth of the "water flow" in the culvert equals "a".

Also compute the cross-section area of the "water flow", usually symbolized as "w"; "P" is the wet perimeter; "R" is the hydraulic radius and equals $\frac{w}{P}$.

Then compute separately the discharge "Q" by using the previous given USSR formula in cu. m. per sec.

Applying the formula $V = C\,R \cdot i$, with an estimated velocity of the water in the culvert.

For the velocity of the water at the discharge point of the culvert multiply "v" by "w" or Q = "v" · "w".

If the "Q" obtained from this method varies more than 10 per cent from the "Q" obtained by using the empirical formula, then compute another assumed "a" until both "Q" coincide or re-design until they come within the 10 per cent range.

3. German Formulas for Waterways and Culvert Area

a. In East Prussia, the formula by Iszkowski is the one adopted -

$$Q = 10^{-3} \cdot C \cdot m \cdot h_n \cdot E \ (m^3/sec)$$

Q = maximum discharge in m^3/sec

c = coefficient dependent upon earth surface, type of soil, etc.

m = coefficient of run-off (area of run-off) or size of basin.

h_n = amount or height of precipitation water per year in mm.

E = area of basin in sq. km.

b. Four other German formulas found in use in Germany.

See pages 885, 886, 875, 878 of THE SPRINGER VERLAY (early edition) 1934 and/or 1949 edition which contains the 1943 formula in The Handbook - "Construction Engineers", Editor - Prof Dr Lug. Ferdinand Schlicher.

c. In Bavaria

Ziegler's formula which originated in Switzerland was favored. (See Applied Hydraulics by Javis. This has a US edition.)

4. Austria and/or Italy

In both of these countries, Javis (Swiss) is found in use but also refer to the Hydrographics by Schaffernak, 1935 - Wien.

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